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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Liu et al.

Application No.: 10/634,964

Filed: 2/27/2003

Title: CHEMICAL MECHANICAL
PLANARIZATION COMPOSITIONS FOR
REDUCING EROSION IN
SEMICONDUCTOR WAFERS

Art Unit:

1765

Examiner:

Patricia Ann George

Attorney Docket No.: 02039US

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

DECLARATION UNDER 37 C.F.R. § 1.132

That I Zhendong Liu declare the following:

1) That I am a current employee of Rohm and Haas Electronic Materials CMP Inc. (fka Rodel, Inc.); and that I have been employed at Rohm and Haas Electronic Materials for over five years in the role of a research chemist.

2) That my professional qualifications include the following:

Ph.D. University of California, Berkeley, 2001

Major: Hydrometallurgy

Minors: Chemistry and Environmental Engineering

Block Grant Fellowship, 1997-1998

Jane Lewis Fellowship, 1998-2001

M.S. Beijing Graduate School, China University of Mining and Technology, 1997

Major: Mineral Processing Engineering

B.S. Huainan Mining Institute, 1994

Major: Mineral Processing Engineering

3) That I co-authored the following articles related to Chemical Mechanical Polishing:

Z. Liu and J. Bian, "Tuning the Removal Rate of Carbon Doped Oxide during Chemical Mechanical Polishing", *210th ECS Meeting, Cancun, Mexico, October, 2006*.

Z. Liu, R. Schmidt and H. Li, "Effect of Wafer Types on the Chemical Mechanical Polishing Rate of Silicon Dioxide", *Proceedings of the 5th International Conference on Semiconductor Technology (ISTC2006)*, Edited by M. Yang, Shanghai, March, 2006, pp. 552-559.

Z. Liu, H. Li, R. Schmidt and R. Baker, "Electrochemical Testing of Tantalum and Copper in Chemical Mechanical Polishing Slurries", *208th ECS Meeting, ECS Transactions*, 1 (4) (2006), pp.465-475.

Z. Liu et al., "Copper Removal Rate Control in Chemical Mechanical Polishing of Barrier Materials", *CMP-MIC*, February 2005.

Z. Liu et al., "Copper CMP Barrier Slurries for Ultra-low k Applications", *CMP-MIC*, February 2004.

Z. Liu et al., "Development of Novel Barrier Slurries for Ultra-low k Applications", *CAMP Annual Meeting*, August 2003.

4) That I have reviewed US Pat. Appln. No. 10/634,964 ('964), filed August 5, 2003; the USPTO action mailed August 18, 2006; and Sun et al. (US Pat. No. 6,709,316) and Scherber et al. (US Pat. No. 5,858,813) and the associated polymaleic acid literature.

5) That Sun et al. at Col. 6, line 33 to Col. 7, line 19 disclose a bulk copper slurry designed for removing copper from semiconductor substrates. Bulk copper slurries typically remove copper at a rate of 2,000 to 10,000 Å/min. Furthermore, these slurries ideally have a zero removal rate for barrier materials, such as tantalum and tantalum nitride.

6) That a skilled slurry design scientist would not expect or attempt to use a bulk copper slurry for second-step barrier polishing that requires high removal rates of barrier materials, such as tantalum nitride.

7) That a skilled slurry design scientist would not expect or attempt to combine bulk copper slurry ingredients with barrier slurry ingredients to manufacture a barrier slurry.

8) That Sun et al. at Col. 6, line 33 to Col. 7, line 19 disclose a first copper CMP slurry at Col. 7, line 20 to Col. 8, line 39. Unlike the claimed slurry invention, this slurry requires the use of a reducing agent.

9) That Sun et al. at Col. 8, line 40 to Col. 9, line 65 disclose a barrier removal slurry that operates at a pH of about 4 to 12 and preferably at a pH of about 8 to 12.

10) That Scherber et al. at Col. 5, lines 43 to 58 disclose maleic acid derivatives as a chelating agent.

11) That polymerizing maleic acid into polymaleic acid would reduce the efficiency of maleic acid as a chelating agent due to the bulky size and slower kinetics of the polymer.

12) That since a scientist skilled in the art would expect that replacing maleic acid with polymaleic acid would reduce chelating efficiency, Scherber et al. teach away from the combined references.

13) That in my opinion, the combined Sun et al., Scherber et al. and polymaleic acid references do not disclose or suggest the addition of water soluble carboxylic acid polymers to a barrier slurry having a pH less than 4 with the pH adjusted with an inorganic acid.

14) That I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the

United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

A handwritten signature in black ink, appearing to be 'Dr. Zhendong Liu', written over a horizontal line.

Dr. Zhendong Liu

November 16, 2006